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ABSTRACT

A study focused on identifying the patterns of participation in vocational education and relating them to various labor market and postsecondary education participation outcomes. Its purpose was to develop a classification schema for vocational education students. The sample consisted of 3,056 high school graduates for whom complete high school transcripts for grades 9-12 were available and was part of the New Youth Cohort of the National Longitudinal Survey of Labor Market Experience. Five descriptive concepts/characteristics (intensity, diversity, continuity, proximity, and supportive diversity) were derived to assign students to five types/patterns of participation or profiles: concentrator, limited concentrator, concentrator/explorer, and incidental/personal. Results of the profile matching showed 22% of secondary graduates with no vocational credits, nearly 50% of those who had exposure to vocational education were in the incidental/personal category, less than 2% were identified as explorers, and the other groups collectively accounted for almost 50%. Cluster analyses indicated verification of the proposed pattern types. Sex, race, and family socioeconomic status had an effect on participation. The classification procedure based on transcript data was found to be a workable way to identify patterns of participation in vocational education. (YLB)

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PATTERNS OF PARTICIPATION IN SECONDARY VOCATIONAL EDUCATION

A Report Based on Transcript and Interview Data
of the 1979 and 1980 National Longitudinal
Survey New Youth Cohort

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FOREWORD

Secondary curriculum has traditionally been classified as either college preparatory, general, or vocational. However, as the demand for reliable evidence concerning the effects of various educational programs has increased, it has become more apparent that the three-way classification scheme may not be an accurate reflection of program content. The variability that exists within programs, especially vocational education, is not reflected in the traditional curriculum descriptors. In addition, in most research reports curriculum classification is based on students' self-report of high school programs, a potentially unreliable measurement. This report, which is the first in a series of three, was designed to address some of these common problems.

The major focus of the report is on the identification of the patterns of participation in vocational education. The combined data from the National Longitudinal Survey (NLS) of Labor Market Experience, New Youth Cohort, (NLS Youth) and the high school transcripts of a subsample of the NLS panel were used for analysis. The transcript data permitted the development of more precise and descriptive curriculum classification measures; comparisons of vocational education patterns among high school graduates were made. The two subsequent papers will deal with the effects of different patterns on labor market participation and on postsecondary education.

This series of reports is the continuation of an effort begun in 1979 to utilize the New Youth Cohort of the National Longitudinal Survey, a research effort that is supported by the U.S. Department of Labor. The continued funding by the U.S. Department of Education, Office of Vocational and Adult Education has resulted in the collection of transcript data and an extensive analysis of the effects of participation in vocational education.

Dr. Michael Borus, Director of the Center for Human Resource Research, The Ohio State University was most cooperative in entering into the agreement under which the transcript data were merged with the interview data of the New Youth Cohort and from which this report was prepared. We wish to express our appreciation to Dr. Borus and to two of his staff members, Susan Carpenter and Michael Motto, who assisted in conducting the analyses for this report.

This project was conducted in the Evaluation and Policy Division of the National Center under the direction of N. L. McCaslin, Associate Director. We wish to thank the project staff, Paul B. Campbell, Patricia Seitz, Morgan V. Lewis, Mollie N. Orth, Fidelia Chukwuma, Sterling Cox and Paulette Robinson for their work in preparing this report. Annegret Harnischfeger of Northwestern University, Edward Marks of Penn State

University, and Larry Hotchkiss of the National Center enhanced the quality of the report through their thoughtful critiques and suggestions. Final edit of the report was provided by Brenda Sessley of the National Center editorial staff.

Robert E. Taylor
Executive Director
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Research in Vocational
Education

EXECUTIVE SUMMARY

This study addressed the problem of the ambiguous description of vocational education as it applies to evaluation, research, and policy formulation. Extensive review of previous work documented the lack of any uniform definition and of a definition that reflects the complexity of the vocational education experience.

A set of descriptive concepts was developed that embodied commonly held assumptions about vocational education. These concepts included intensity of training, continuity of training, proximity of training to time of employment seeking, the diversity of program areas in which training was received, and the addition of logically related study outside the main area of concentration. These concepts were made operational by defining them in quantitative terms relating to credits, points in time, and areas of specialty. Patterns of participation were then described and tested against a sample of secondary vocational education participants.

The sample consists of high school graduates for whom complete high school transcripts for grades nine through twelve were available. The sample was part of the New Youth Cohort of the National Longitudinal Survey of Labor Market Experience. It was judged to be adequately representative of high school youth in terms of sex and race. This is because it deviated less than 2 percent from frequencies of these characteristics in an other comparable national sample when weighting to account for selection probabilities was applied.

Testing the patterns within this sample demonstrated clear differences in patterns of participation in vocational education. Five patterns were identified ranging from extensive involvement and commitment to vocational education to incidental use of available courses without establishing a specialty. The Concentrators (14 percent) were those who took a substantial number of courses in a specialty area, engaged in a continuous program, and studied in the specialty up to the point of graduation. A group called Limited Concentrators (23 percent) were similar except that they tended to take somewhat fewer credits with some breaks in program continuity and occasional termination after the eleventh grade. Another group, Concentrator/Explorers (13 percent), tended to concentrate early in a specialty but frequently ended concentration after tenth grade. They also had, in general, fewer courses in the specialty and tended to crowd them into one or two years. There was a small group described as Explorers (2 percent), who sampled widely across program areas but did not develop a specialty. Finally, a large number of students (48 percent) used the vocational education opportunity to accumulate a small number of credits that were insufficient to be considered salable skills. This pattern was called Incidental/Personal.

The patterns held up well under alternative analyses. For example, when cases were reassigned to the patterns by discriminant function, over 92 percent of the original assignments were duplicated, even though the discriminant function analysis used somewhat different information. There are also apparent sociodemographic influences upon the patterns of participation. High socioeconomic status (SES) persons are predominantly Incidental/Personal or nonparticipators in vocational education. Over 80 percent were found in these two groupings. In contrast, 54 percent of the low SES high school graduates had developed specialities in a program area. Forty-seven percent of the females had at least some concentration in a program area, while only 30 percent of the males showed the patterns of Concentrator, Limited Concentrator, or Concentrator/Explorer. A higher percentage of Hispanics and blacks were also classified in these three patterns. Forty-three percent of these students were so classified, compared with 38 percent of the white and other students.

The authors recommend that, in addition to further tests of the adequacy of the pattern identification procedures, it is essential to consider the variety of patterns of participation when evaluating vocational education. Therefore, this method of classifying participation patterns, or a similar one, should be used when testing for the outcomes of vocational education.

It is also recommended that policymakers consider very carefully the diversity of the vocational education experience as they make decisions about the delivery of vocational education services. Nearly 50 percent of the high school graduates who utilized vocational education offerings in their schools did not do so in a manner that was directed toward securing specific employment. If the value of vocational education is based on employment alone, and vocational education limited to individuals with that objective, then an education option for a large group of high school students will no longer be available, and more widely informed career decision making will be further curtailed. If, on the other hand, evaluation of vocational education does not take into account the variety of Incidental/Personal participation in vocational education, the employment effects may appear to be quite inconclusively demonstrated.

The second and third papers in this series will apply in part these recommendations as they relate to evaluation and research.

CHAPTER 1

INTRODUCTION

The development, implementation, and maintenance of vocational education programs involve a heavy commitment of human and financial resources. Publicly assisted vocational education programs enroll about 17 million people per year (Golladay and Wulfsberg 1980). The programs, not including those in the private sector, cost more than $6 billion in 1979. Vocational education, therefore, required examination to determine the relationship of the achievements to the costs incurred.

Participation in vocational education varies in ways that are likely to affect its outcomes or consequences. Students may participate in as little as one or two courses or may devote a substantial part of the secondary school experience to vocational education. The accumulation of course credits alone does not reflect adequately, however, the variability of participation. The timing and continuity of course taking may also be a source of variation that could affect the outcome. Students may take vocational courses early in the high school years and then move to other areas of the curriculum for later years. The reverse pattern may also be true. Still further variability could occur in concentration in a specialty area. It is possible that some students may sample courses across several fields of specialization without concentrating, others may sample two or three specialties and then concentrate on one, while others may abandon vocational education entirely after some exploration.

The reasons for this variety of participation are also a source of potentially significant variation in terms of consequences. Students may participate differently by reason of motivation, program requirements, program availability or scheduling constraints. In motivational terms, students may enter vocational programs because they have a side interest in the program area, because other avenues are closed, because they receive parental or counselor pressure, because they have an occupational goal related to the specialty area, or because they see it as the most direct escape from economic dependence. It is self-evident that program availability, program requirements, and scheduling constaints will dictate in part how a student participates. Also, it is likely that individual program requirements may affect the participation patterns. As documented in the subsequent literature review in this chapter, for example, it is likely that students in agricultural programs will start earlier, probably in the ninth grade, and therefore will have more opportunity to accumulate courses than students in health programs, who typically do not begin course work in this specialty before eleventh grade.

Depending on the manner in which vocational education is measured, the outcomes of participation may also vary. This issue is particularly crucial to the evaluation of the effects of vocational education since heavy emphasis is placed on outcomes in the federal legislation and in related educational research. There are two characteristics of existing research studies that have impeded a distinct identification or classification of vocational educational students. These are (1) the categorical classifications of educational program participation, which do not reflect variability in student course taking, and (2) the potential unreliability of students' self-report in the identification of the program in which they participated. At best, the traditional three-way classification of secondary curricula, academic (college preparatory), general, and vocational, describe modal patterns of courses and not mutually exclusive categories. Even within these curricula there can be considerable variability, and this is particularly true of the vocational classification. A second limitation is the potential unreliability of student self-report of program participation when compared to either school administrator classifications or to transcript information (Fetters 1975; Schmidt 1980).

A number of national longitudinal studies, including the National Longitudinal Surveys of Labor Market Experience (NLS) and the National Longitudinal Study of the High School Class of 1972 (Class of 1972) have been used to study the effects of vocational education, particularly on labor market participation, and more specifically, job placement in a training related area. There are some limitations with this objective since the longitudinal studies were not designed for that purpose. The comprehensiveness of the large scale data bases, however, importunes that an attempt be made to utilize the data to the greatest extent possible.

This data base does not provide information on motivation, scheduling, and program requirements. Nor does it provide any indication of the quality of programs available to students. Therefore, the major objective of this study is to identify the patterns of participation in vocational education and to develop a more comprehensive method with which to define the vocational education experience of students for the purpose of examining the broad effects of secondary vocational programs. In an effort to improve and build on a substantial existing data base, transcript data for persons in the New Youth Cohort of the NLS data base were collected by the National Center for Research in Vocational Education and were used for this analysis. The NLS Youth Cohort provides recently collected interview data on individuals of the appropriate age group; includes dropouts as well as high school graduates; and has the potential of being a long-term study, with up to twenty years of data collection.

Organization of the Report

The remainder of this chapter will present a literature review of the studies pertinent to the questions addressed in this report. This is followed by a discusssion of the framework and methodology used. Description of the NLS Youth Cohort data and the transcript data is provided in chapter 2. The chapter includes a discussion of the sampling and weighting processes, the type of data collected, and an explanation of how an appropriate subsample to be used for analysis was obtained. Chapter 3 contains the specific concepts used to develop the indices of participation, the rationale for the inclusion of the concepts, and a description of the methods by which the analyses were conducted and verified. The findings and results of each analysis are presented in chapter 4; an integrative summary and proposed recommendations follow in chapter 5.

Literature Review

A review of the literature was conducted with two basic objectives in mind: How is the conceptualization of "vocational students" treated in the previous research and what are the findings and related issues, including methodological considerations, when an alternative measure of vocational education is used? Only recently have researchers attacked this issue directly by employing transcript information to determine a student's area of study. Usually only a discussion of the possible effects of different curriculum measures precedes any major analyses. The findings from the literature search can be categorized into three groups--classification issues, substantive findings and related issues, and outcomes issues.

Classification Issues

In an extensive summary of the studies concerning the effects of vocational education, Mertens et al. (1980) reported that several methodological problems were encountered in the review of the literature. Mertens noted that vocational programs may be similar in name only, and considerable variation within programs may exist. This observation was determined to have important consequences for the validity of an effectiveness study. It also influences any comparison of findings among various studies. Reviewing nearly 300 documents, Mertens also found that identification of secondary curriculum is typically based on self-report and "in very few instances is (was) there an attempt to define vocational education" (p.15). A review of the national studies concerning the effects of vocational education by Grasso and Shea (1979) revealed similar findings. Berryman's report (1980) on the effectiveness of vocational programs, a study that is also based on a review of the published literature, suggests previous researchers are seemingly unaware of alternative classification schemes. In general, the sensitivity of the curriculum measure has not been assessed in conjunction with research results.

At the center of the classification issue is the question of the method by which vocational students are identified and the reliability of the measure. In his work with the Class of 1972 data, Fetters (1975) found substantial disagreement between student's self-report of curriculum and administrator classfication of the same. Approximately 66 percent of the students whom administrators categorized as having followed a vocational program reported the same program. The program "match" for general curriculum students was 60 percent, and a 78 percent "match" was found for academic students. Among vocational students, 26 percent reported a general program and approximately 8 percent reported being in an academic program.

In Schmidt's (1980) work with the Class of 1972 data, considerable differences in actual course taking were found not only between the three major curricula (as defined by student's self-report) but also within the respective vocational, general, and academic programs. Using the same data base, Fleming, Maroney, and Straser (1975) state that many high schools make few distinctions between the available curricula and only with regard to academic courses is agreement firm. The authors further suggest this lack of clarity may be an underlying cause in the closeness of various indicators between vocational and general curriculum students. (Also see Wiley and Harnischfeger 1980.) Conger, Conger, and Riccobono's (1976) study of the reliability of various measures in the Class of 1972 data found that "objective, factually oriented items are more reliable than subjective, temporally remote, or ambiguous items" (p.31). Given the lack of agreement on program content by the school itself, the reliability of self-report as a measure of curriculum becomes suspect. This observation is concurrent with the findings of Pucel and Luftwig (1975) in a reliability study of a statewide student questionnaire. The responses to a curriculum item were found to be among the least consistent of the items studied; the rate of reliability ranged from 57 to 78 percent for the three follow-up surveys.

Substantive Findings and Related Issues

Several studies have recently emerged, which support the contention that enough variability exists within the general term "vocational education" to warrant a more detailed definition of the program. For example, a study by Brown and Gilmartin (1980) using the National Center for Education Statistics (NCES) Public Secondary School Offerings and Enrollment Data and the Class of 1972 data, found only slight differences in the number of vocational courses taken by students reported to be in a program and those who were taking courses as electives. Examining the same groups by the average hours per week in class, however, revealed that vocational program students received about 56 percent more instruction than elective takers due to longer class periods. The authors describe the "program life cycles" of students in the various vocational program areas, identifying differences in the number of years in the program (i.e., agriculture students usually start their program earlier, between ninth and tenth grade, than students in other program areas). Differences are also noted in the number of vocational courses taken within and outside the program area. In summation, Brown and Gilmartin suggest that "grouping all vocational education students together and treating them as a homogenous conglomeration can only lead to false conclusions . . ." (pp. 43-44).

As previously noted, Schmidt (1980) also used the Class of 1972 data to analyze student's "course taking patterns." Using four subject areas, math, science, foreign language, and vocational education, with two levels for the number of semesters taken in each area, Schmidt crossed the variables in a factorial design to form sixteen patterns. Of these, five patterns accounted for nearly 80 percent of the student's course taking experiences and overall, approximately 60 percent of the sample had taken more than two semesters of vocational courses. Differences by sex and race were also noted between the patterns. Wiley and Harnischfeger (1980) found similar differences by sex and race by examining the number of vocational hours received by each group.

Copa and Forsberg (1980) analyzed students' transcripts in a statewide study in Minnesota. The hours of vocational coursework were compared to a variety of factors, and in general, it was observed that approximately 78 percent of the students in the survey had taken at least one vocational course. As the number of vocational hours increased, students were more likely to be concentrated in one program area, to be of lower class rank, to work at paid employment, and to go to a specialized vocational school. Copa and Forsberg conclude with the recommendation that any measure of curriculum should not be based on a single criterion and that the amount and type of courses taken should be included in any definition.

Another major study found that the percentage of students enrolled in vocational courses generally increased with each subsequent grade level, although the rate of increase was not evenly distributed among the program areas (Osso 1974). The data, collected by students' self-report of the number and class-period length of vocational courses, also support the findings of other studies.

Outcomes Issues

The reported findings and conclusions of previous studies intuitively point to the need to consider the possible implications of using an all encompassing method to classify vocational students when evaluating the effects and outcomes of vocational education programs. While many of these studies have used alternative classification measures to examine the labor market and postsecondary schooling experiences of vocational youth, a review of the specific findings is reserved for the upcoming reports in this series. However, several more general observations about the possible effects of alternative vocational measures on outcomes are worthy of note.

The legislation and previous research have placed heavy emphasis on the effects of vocational education. The focal point of both is primarily on the labor market experiences of vocational students, particularly in terms of training related job placement. Several studies have discovered, however, that all students do not enter vocational programs for the same reasons, and the motivation for seeking such training may not be consistent with the intended purpose of vocational education. For example, Osso (1974) found 33 percent of the secondary students surveyed in the NCES Public Secondary School project had selected a vocational program because they "wanted to work in this field," but 25 percent, the next highest response, reported it "sounded like a good idea when I heard or read about it." (Unfortunately, occupational exploration or preparation for postsecondary education were not included as possible responses.) Osso also found differences by program area; health program students most often reported the desire to work in a related area, and home economics students were least likely to select this response. In Collett's study (1978) of Canadian students, responses to a similar question were also differentiated by program area.

A state survey of students who attended specialized vocational schools reported a higher percentage of students enrolled in the vocational center in order to prepare for postsecondary education than to prepare for a job, 27 percent and 22 percent respectively (Edin 1977). The same study found that over 18 percent of the students expressed the desire to explore different occupations. The occupationally related items were more often reported by males and females more frequently selected the education related responses. Of equal interest are the responses of secondary teachers regarding the goals of vocational programs in Copa and Forsberg's study (1980). Instructors rated the primary importance of vocational education to be occupational exploration (61 percent), followed by preparation for further education (25 percent), and job preparation (8 percent).

While an investigation into the "why" of vocational course selection is not the intended purpose of this report, the findings of the studies cited in this review are related in as much as they demonstrated that students and teachers perceive the intent of vocational programs differently, and they are likely to use vocational education differently--i.e., students who enter vocational programs for the purpose of occupational exploration may participate differently than those who have a clear idea about the type of job they wish to pursue. Accordingly, an evaluation of the effects of vocational education which treats the concept as an across-the-board course of study, would fail to incorporate students' differing motivations and types of participation.

Grasso and Shea (1979) expand upon this issue and suggest self-report of curriculum is inappropriate for examining the effects of vocational education if program is to be considered analogous to the content of coursework. Self-report is judged to be a valid measure if the intent of the research is to examine "student's orientation to the high school experience" (p.107). Otherwise, the use of self-report data may show stronger relationships between curriculum and the effects ". . . owing to the common dependence of self-report and other social-psychological factors on other attributes. . ." such as aptitude, college plans, and occupational aspirations (p.108). Another potential factor that may confound the results of studies, which use the generic category of vocational education, is the issue of curriculum entry and change. In general, the research shows that movement among the various curricula is usually directed from a general (or less often, an academic) program to a vocational program (Bachman 1972; Rosenbaum 1976; Schafer and Olexa 1971). Berryman (1980) maintains that we cannot accurately estimate the actual effects of curriculum on various outcomes because the data do not provide the information necessary to determine the rate or timing of "initial curricular branching" compared to "intercurricular migration" (p.12). Grasso and Shea (1979) further state that the evaluation of a "vocational" graduates who enter the program late in their high school career and are subsequenty classified as vocational, may be reflecting the failure of their general curriculum studies rather than the vocational instruction received.* The evidence strongly suggests that the use of a student's self-report of curriculum has important consequences for the evaluation of the effectiveness of vocational programs, and, to date, the implications of the classification have not been quantified with research.

Framework and Methodology

Several basic questions were used to guide this inquiry into the realm of vocational education participation. These questions can also serve as a framework for our analyses.

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* Also see Alexander, Cook, and McDill (1978) for a discussion of the importance of precurriculum controls and the effect on outcome variables.

First, how do secondary students participate in vocational courses? What is the nature and extent of participation? A valid case can be made from a review of the pertinent literature that the traditional identifier of curriculum, i.e., the generic term vocational, is not the best indicator of the high school experience. Previous studies indicate that students have different levels of participation in vocational education. They may take courses in more than one area, and at different periods in their high school career. The evidence concerning the intended reason and motivations for selecting a vocational program also suggests we should not expect students to participate in vocational courses in a unidirectional manner.

Second, are there discernible patterns of participation in vocational courses, and, if so how can we optimize the information used to develop and describe the patterns? Thus far only a few studies have examined this question with any rigor. While previous studies have contributed greatly to the body of knowledge about participation in vocational education, most of the work has not incorporated the components of the vocational experience considered to be important into a operationalized concept that describes a type of participation. Concepts such as the number of program areas and the number of courses or hours taken are treated separately rather than collectively.

Third, are there differences between the type of participation and sociodemographic variables such as sex, race, and socioeconomic status. For example, differences by sex and race in the number of vocational hours taken have been noted in previous studies, in addition to the reasons reported by students for selecting a vocational program. The possibility for interactions between the type of participation and various independent variables are strong given the findings of past research. One last concern was the development of possible patterns that could be used to more accurately assess the relationships between the secondary school experience and post-high school activities in the labor market and in the educational system.

Using these questions as a foundation, a framework for the analyses was developed. Several theoretical assumptions about the delivery of vocational education services were enumerated and then linked to definable concepts that describe vocational experiences. The concepts contain the elements of students' course-taking behavior, such as the number of credits received for vocational course work, which would allow the examination of the nature and extent of participation. These concepts were incorporated in such a manner as to permit the testing of the data in order to identify the possible patterns of participation. That is, the patterns were developed from initial assumptions about the vocational education delivery system and concepts which, if taken individually, only tap into a portion of the overall participation picture. The patterns were then compared to other variables of interest such as sex and race.

CHAPTER TWO

DESCRIPTION OF THE DATA

The data used for analysis in this study were taken from the combined National Longitudinal Survey of Youth Labor Market Experience (NLS Youth) and the high school transcripts of a subsample of the NLS panel. The Center for Human Resource Research (CHRR), with support from the U.S. Departments of Labor and Defense, initiated the NLS Youth data collection in 1979. At the time of the first interview the participants in the survey were asked to sign a release permitting the disclosure of their high school transcripts. In 1980, with funding from the U.S. Department of Education, Office of Vocational and Adult Education, and under a collaborative agreement with CHRR, the National Center for Research in Vocational Education obtained the high school records of the NLS Youth respondents who were seventeen years of age or older at the time of the first interview.* The merger of the two data sources provides a cost-effective and unique information base to examine the course-taking behavior of secondary students and to better evaluate the post-high school activities of youth.

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* The transcripts of respondents who were fifteen and sixteen at the first interview are being collected in the current contract year. Plans to collect the transcripts of respondents who were fourteen at the first interview are underway.

Description of the NLS Youth Cohort

The 12,686 persons included in the NLS Youth sample were selected by a household screening process in the fall of 1978; the New Youth Cohort represented a national probability sample of youth between the ages of fourteen and twenty-one when originally selected. The sample was drawn in three stages: a cross-sectional sample, a supplemental sample of blacks, Hispanics, and economically disadvantaged whites; and a sample of young persons serving in the military. Both the cross-sectional and supplemental samples were stratified by sex in order to obtain relatively equal proportions of men and women. The military sample includes an oversampling of women; it is roughly composed of one-third women and two-thirds men. Because blacks, Hispanics, and economically disadvantaged whites are purposefully overrepresented in the NLS Youth sample, a weighting procedure was developed to permit more accurate estimates of these various combinations of the youth population.* Approximately 2 percent of the NLS respondents are Native Americans or of Asian or Pacific Island descent; these minority members are classified as white in the survey.

Extensive background information about family, schooling, work history, and training was gathered for all the respondents in the NLS Youth Survey when they were first interviewed early in 1979. In addition, data on current educational and labor market activities were obtained. The first follow-up interviews were conducted in 1980. The rate of attrition in the second round of the survey was 4.3 percent, yielding a sample size of 12,134. Persons originally classified in the military sample and who are no longer in the active forces have been reassigned to the civilian sample. Follow-up interviews are scheduled with the participants in the New Youth Cohort through 1984.

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* For a full description of the sampling and weighting procedures used in the survey and a descriptive analysis of the first year's data, see Borus et al., Youth Knowledge Development Report 2.7 Findings of the National Longitudinal Survey of Young Americans, 1979 (1980).

NLS Youth Transcript Collection Effort

The transcript collection effort was initiated through a subcontract let by The National Center for Research in Vocational Education to the National Opinion Research Center (NORC) at the University of Chicago to secure and code the transcripts of the NLS Youth respondents. Concurrent with the transcript survey, CHRR distributed a school questionnaire and a student's record information questionnaire to the schools. The target sample for the data collection, which was conducted in 1980, was youth seventeen years and older at the 1979 NLS interview (N=8,420). Persons excluded from the transcript collection were those less than seventeen years of age who presumably had not completed secondary school, persons in the military sample, and youth in foreign high schools. With several follow-up efforts, including additional mail outs, telephone checks with school officials, and on-site data collection, a 77 percent response rate was achieved. If a student had transferred and the original school's transcript was not complete, extensive efforts were made to locate and contact the new school to obtain the student's record.

The coded information, if available, from the individual transcripts included: (1) days absent, grades nine through twelve; (2) academic rank in class; and (3) math and verbal scores for aptitude tests (Preliminary Scholastic Aptitude Test, Scholastic Aptitude Test, American College Test). Course information included the specific course taken, the grade (or year) in which the course was taken, the letter grade received, and the credit received for the course. Each course credit was converted to a common scale, the Carnegie credit unit, at the time of coding. This system assigns 1.0 credit to a standard full-year course, or one course taken one hour a day for 180 days. Courses were given the appropriate credit depending on: (1) the credit system used by the school; (2) the time period in which the course was taken (quarter, trimester, semester, or full year); and (3) the amount (or hours) of class time. The Carnegie credit-unit system provides a method that is sensitive to the length of time spent in the classroom, contrasted to a simple count of courses taken, thus facilitating a comparison of the youths' vocational education experiences on a national level. A conversion table relating the number of credits to hours of course work and percentage of total school time is presented in Appendix A.

A coding system to identify the actual courses taken by the student was developed from the Standard Technology for Curriculum and Instruction in Local and State School Systems Handbook VI (Putnam and Chismore 1970). The course identification scheme consisted of a two-digit, subject matter prefix (e.g., Math, English) followed by a two-digit code, which specifies the individual course within the general category (e.g., Math I, American Literature). If possible, courses that were identified as part of a vocational curriculum, such as an English course, which was taught in a specialized vocational center, were distinguished from college preparatory or general curriculum courses. In addition, upper-level courses and honors classes were differentiated from lower-level instruction. A description of how vocational courses and programs were defined for this study is provided in Appendix B.

In addition to the NLS interview information and the transcript data, two other information sources have been merged with the files to complement the existing data. The NLS School Survey, developed by CHRR, obtained information about school characteristics such as the availability of vocational programs, school enrollment, percentage of early school leavers, and percentage of minority students and faculty. The Student's School Record Information, which was also distributed by CHRR at the time of the transcript collection and completed by a school administrator or designated school personnel, has information on the date and reason the student left the school (i.e., graduated, transferred, expelled, etc.), whether the student participated in a remedial or bilingual education program, and the scores (if available) received on various aptitude tests. While these data were not used extensively in the present effort, the comprehensive information available for NLS Youth respondents is well suited to vocational education research.

Description of the Data Used For This Study

The proposed focus for this research effort, determining the patterns of participation in vocational education, suggested that several methodological considerations should be taken into account in the selection of a subsample to be used for analysis. A primary objective was to maximize the number of transcripts used and yet preserve a relatively homogeneous sample in terms of exposure to vocational programs and courses. For example, students in four-year secondary schools may have different opportunities and/or entry points to pursue vocational courses than students in three-year high schools. Similarly, students who drop out before completing high school have less exposure to vocational offerings than those who graduate. Another factor concerned the demographic distribution of the subsample and the generalizability of results in terms of the youth population. While the New Youth Cohort is a national probability sample, the present transcript collection effort was restricted by age; and the representativeness of the sample is potentially affected by the school response rate.

To accommodate these factors and to obtain an appropriate subsample for the analyses, several decision rules were applied to the data. Only civilian respondents who had reported completing high school were used in the analysis (N=5,008). Recognizing that students have different reasons and motivations for remaining in school, this strategy provided a common denominator with which to examine the high school experience. The measure of educational attainment was based on the 1980 NLS interview.

The sample was limited to transcripts that had course information for grades nine through twelve (N=3,056). Because many school systems place ninth grade students in the junior high school, not all transcripts had information available for grade nine. (No attempt was made to collect transcripts from junior high or middle schools.) The possibilities for students to explore vocational opportunities or initiate an intensive program of study in grade nine were determined to be important factors given the nature of this study. Transcripts from the civilian sample were used because the patterns of vocational participation developed in this report are to be used to examine the labor market and postsecondary educational activities of youth. It seemed appropriate to separate the civilian and military samples in order to provide continuity to the subsequent studies of vocational outcomes.

Using these criteria, a sample size of 3,056 was obtained from the subsample of respondents who had graduated from high school by 1980. While considerable variability exists in the

TABLE 2.1

SAMPLE AND ESTIMATED POPULATION COMPARISON OF HIGH SCHOOL GRADUATES BY SEX AND RACE

Sex/Race	Sample and Estimated Population			
	Unweighted NLS Sample of High School Graduates With Complete Transcripts	Weighted NLS Sample of High School Graduates With Complete Transcripts	BLS Population Estimates of High School Graduates[1]	Percentage Point Difference Between the Weighted NLS and BLS
Male	44.3%	48.0%	46.1%	+ 1.9
Female	55.7%	52.0%	53.9%	- 1.9
White	68.5%	86.9%	85.2%	+ 1.7
Black	19.4%	9.1%	10.5%	- 1.4
Hispanic	12.1%	3.9%	4.3%	- 0.4
Total	100.0%	100.0%	100.0%	

Note: The age range of persons selected for the two independent samples (which are used to obtain population estimates) varies somewhat; the NLS estimates are based on a sample of youth from ages fourteen to twenty-one and the BLS included persons between the ages of sixteen and twenty-four. Both estimates represent the noninstitutional civilian population.

[1] U.S. Department of Labor, Bureau of Labor Statistics. School and Work Among Youth During the 1970's Special Labor Force Report 241. (Washington, DC: U.S. Dept. of Labor, January 1981), p. 45.

amount of credits received, the restrictions placed on the selection of the transcripts facilitate more precise estimates of vocational education participation.

The Transcript Subsample and Comparable Population Estimates

The sex and race distribution of the transcript sample of high school graduates and comparable population estimates of the same are presented in table 2.1. The percentages shown in the unweighted column represent the proportions of the actual number of cases used for analysis. Notably, there is a high percentage of females compared to males; the disparity in the sample composition by sex is partially due to the differential graduation rates of males and females. In addition, blacks and Hispanics are overrepresented. This is primarily a function of the oversampling of these groups in the NLS Youth sampling design, although the proportions of each race group are also affected by graduation rates. The sex and race distribution of the sample has potential implications for our analyses of vocational participation. Studies that have used both self-report and school record classification methods have shown sex and race factors to be influential in the selection of curriculum (i.e., college preparatory, general, or vocational) and if vocational, the selection of program (i.e., office occupations versus trade and industrial occupations) (Grasso and Shea 1979; Schmidt 1980). To adjust for these influences and render the data applicable to the national level, the weighted sample is used in the subsequent analyses whenever possible.

The sampling weights function to bring the reduced sample "back into line" and allow it to be generalizable to the target population of secondary graduates.

The table also shows the composition of the weighted transcript sample by sex and race and the population estimates for high school graduates (as of 1979) published by the Bureau of Labor Statistics (U.S. Department of Labor 1981). Despite differences in the age ranges included in the estimates and different sampling and weighting procedures, the comparability of the two independent sources supports the representativeness of the NLS Youth data on these significant variables. Comparing the transcript sample to the BLS estimates, the data show our weighted sample contains a slightly higher proportion of males and whites (approximately two percentage points). While the differences in sex and race are minimal, the possibility exists of over- (or under-) stating our findings and conclusions if all the additional cases were placed in a particular group. For example, if a specific pattern of vocational participation is found to be more highly associated with success in the labor market, and all additional male respondents were categorized in that group, the results would be slightly tempered by the influence of sex. It is much more likely, however, that the additional cases will be proportionally distributed among all categories and will not substantially affect the findings.

The distribution of the sample was also examined with respect to other sociodemographic variables such as geographic region, rural and urban residence, and family socioeconomic status. A comparison was made between the reduced sample and the NLS population distribution of high school graduates, a subsample that is not influenced by transcript availability. These data are presented in table C1 in Appendix C. The reader is also referred to table C2 in Appendix C, which shows descriptive statistics for selected school and personal characteristics for the transcript sample used in the analysis. In sum, the combined NLS Youth interview data and the transcript data provide an information base that can be used to investigate the secondary vocational experiences of youth on a national level. A discussion of the concepts and techniques used to examine the patterns of vocational participation is presented in chapter 3.

CHAPTER 3

THE APPROACH TO ANALYSIS

What are the patterns of participation of students in vocational education programs? To answer this question several characteristics were postulated that might describe the patterns. Initially, there were four expected types:

- Concentrators who pursued a continuous sequence of related courses
- Explorers who sampled a wide variety of courses
- Explorers who subsequently become concentrators
- Concentrators who abandoned concentration and become explorers

To develop working definitions for each type, a set of descriptive concepts were derived that could be scaled in terms of the actual data. These concepts were selected because they represented dimensions in that the nature of the patterns of participation could vary, and dimensions that could reasonably be expected to relate to several different outcomes of vocational education.

The concepts are based on assumptions regarding vocational education and its delivery system: (1) courses in the eleventh and twelfth grades are more important to vocational attainment than those in the ninth and tenth grades; (2) continuity in an area is better than switching areas; (3) the more credits individuals have the better prepared they are; and (4) continuity in terms of school years is better than broken sequences. Expanding on the details of the assumptions and the proposed pattern types, the descriptive concepts and their scales are listed and defined.

Definition of the Concepts Used to Describe the Patterns of Participation

The first concept is intensity. This descriptor is defined as the number of credits earned in a single area of concentration. In order to qualify as part of the measure of intensity, the credits had to be in an area of specialization (e.g., trade and industry, agriculture) in which the student had accumulated at least six-tenths of his or her total vocational credits. There also had to be at least one full credit to earn a score in intensity. The score of an individual is the actual sum of Carnegie Units of the vocational courses taken.

The second concept is that of diversity. In contrast to specializing in a single program area, a student may take a variety of courses across several program areas without accumulating a substantial body of experience in any single area. The score for this concept is the number of program areas in which courses are taken.

The third concept is continuity. It is the number of grades in which the area of specialization, as defined for intensity, is pursued. It reflects a different dimension than intensity because, in many cases, a relatively large number of credits was accumulated in a single grade, while in others a similar number was accumulated over two or more years. The score is the actual count of the grades in which greater than a half credit in the specialty was earned.

The fourth concept is supportive diversity. This concept is tenuous, but was included because an examination of actual patterns suggested the possibility that some across-area work might be supportive of the utilization of the body of knowledge and skills accumulated in a specialty. The score is an actual count of credits earned in courses judged to be potentially related to the specialty. One example would be the benefit of some knowledge of accounting for a self-employed person such as an auto body shop owner. A list of the courses used in the supportive diversity concept is found in Appendix D.

The fifth concept is proximity. This notion rests upon the classic theories relating the rate of forgetting to elapsed time, and upon the possibility of greater knowledge of the immediate job market at the time employment is sought. The scale is arbitrary in this instance, although its ordinality has a theoretical base. If more than one-half credit was taken in the specialty in each of the last two years of high school, a score of three was assigned. If specialty courses were taken in the twelfth grade but not in the eleventh grade, two was assigned. If specialty courses were taken in the eleventh grade but not in the twelfth grade, a one was assigned. If no specialty courses were taken in the last two years, a zero was assigned.

To summarize, the five descriptive concepts and their working definitions are as follows.

Profile Characteristics

	Concepts	Score Assignments
1.	Intensity	- Number of credits in a specialty in which at least 0.6 of total vocational credits were earned.
2.	Diversity	- Number of areas in which vocational credit was earned.
3.	Continuity	- Number of grades in which same specialty was pursued.
4.	Supportive Diversity	- Number of nonspecialty credits logically career related to specialty.
5.	Proximity	- 3 points for vocational credits in both the eleventh and twelfth grades in concentration; 2 points for credits in the twelfth grade; 1 point for eleventh grade; 0 for all others.

Development of Target Score Profiles and the Profile Matching Method

Using the descriptive concepts, target score profiles were constructed.* The term "target" is used because the score profiles represent the hypothesized most likely set of score values associated with each pattern type. The initial target profiles were evaluated against a pilot sample of cases in the data base. Several modifications resulted from these processes and the adjustments were made to the target profiles and pattern names as appropriate. Five patterns or types of participation were tentatively identified in the pilot activity, and score values were assigned to each of the descriptive concepts in the target profiles to be tested in the data.

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* The term "profile" refers to a set of scores assigned to a case for each of the five descriptive concepts. The term "pattern" denotes a type of participation in vocational education. Pattern assignments are made based on profile scores.

Assignment of Case to a Pattern

Before discussing the rationale for the assignment of scores to the target profiles, an explanation of the profile matching concept is in order. The transcript data were used to obtain a profile for each individual case record; that is, each case in the sample received a set of scores depending on the information contained in the transcript. The method selected for comparing the actual case profiles to the target profile was a form of cluster analysis. This technique, which is a method of synthesis, meets the objective of assigning each case to one and only one pattern rather than trying to separate the variance in each case into additive parts as would occur in a factor analytic solution (see Thorndike 1978, p.224).

The Euclidean distance function (in D^2 form) was employed to assign each case to a pattern type. This function has been used in a variety of approaches to cluster analysis, the method proposed to examine the occurrence of patterns in the data base (see, for example, Milligan 1981). It was defined in this study as the sum of the squared differences between the values in the case profile and those in the target profile. These distances were computed for each comparison between case profiles and target profiles (five distances for each case profile), and the case was assigned to the pattern from which it had the least distance.

It should be noted that the target profiles do not set up the boundaries of pattern types, but rather represent the modal type. Assignment to type is made by determining the target profile from which a given case has minimal distance. The actual case profiles classified as members of a pattern group will not necessarily be exact matches to the target profile associated with the respective pattern. The actual cases cluster around each target profile. Target profiles may be identical on one or more scores but must differ on at least one. They should be closer to conceptually similar profiles than to conceptually dissimilar ones. Thus, when scores are assigned, there should be a reasonable fit of the resulting target profiles to these criteria.

Description of the Target Profiles

Referring to table 3.1, the target profile for Concentrator was assigned a value of five for intensity, one for diversity, four for continuity, one for supportive diversity, and three for proximity. The intensity score of five represents a judgment that a Concentrator would probably need to use most of the available time not required for other subjects in a vocational specialty. A Concentrator is defined as a person who does not necessarily use all electable credits in the specialty, but a substantial majority of them. The student with credits in a specialty in excess of five could still be classified as a

TABLE 3.1

TARGET PROFILES

Pattern Name		Descriptive Concepts and Score Assignments				
		Intensity	Diversity	Continuity	Supportive Diversity	Proximity
1.	Concentrator (C)	5	1	4	1	3
2.	Limited Concentrator (LC)	4	2	2	1.5	3
3.	Concentrator/Explorer (CE)	3	3	2	1	0
4.	Explorer (E)	0	4	0	0	0
5.	Incidental/Personal (IP)	0	1	0	0	0

Concentrator, since that condition would increase the distance from other target profiles to a greater degree than to the reference profile. The diversity score is set at one because the Concentrator is not likely to have many election options, although a possibility for such options remains. The continuity score is set at four to reflect the likelihood of the true Concentrator pursuing the specialty throughout high school. Supportive diversity is set at one to offset a possible increase in distance if a nonspecialty course is taken and if there is a logical relationship between that course and the specialty of concentration. An example might be an accounting course taken by an agriculture student. The proximity score of three is the highest value for this descriptor and reflects dedication to the specialty in the last two school years.

After consideration of cases in the pilot study, the second pattern was labeled Limited Concentrator because it seemed to reflect not only some exploration within the vocational field, but also a higher degree of course taking outside vocational education. The score of four has been assigned to intensity for this profile, to reflect the fact that concentration is present. Diversity receives a score of two; continuity is reduced to reflect the lessened concentration during the high school years. There is more opportunity for supportive diversity to occur, thus the score of one and one-half credits has been assigned to this profile. The proximity score remains at three, reflecting concentration in the last two years of high school.

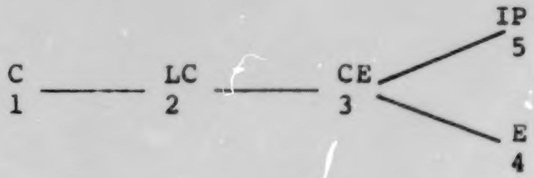
The third profile, Concentrator/Explorer, has a reduced intensity score of three credits because the opportunity for specialization is less in the early years of high school where concentration on this profile is postulated to occur. Greater diversity is reflected in a score of three for this descriptor, possible because of the expanded opportunity in the later high school years. The continuity score remains the same as that for the previous profile, for a similar reason--the time requirements for the exploratory branching. Supportive diversity remains a possibility and thus, a score of one is assigned. Lack of concentration in the later years of high school is reflected by a proximity score of zero.

The fourth pattern, Explorer, fits cases where no predominant specialty is established, thus requiring a profile score of zero in intensity. Diversity characterizes this profile, however, as indicated by a score of four. Because continuity is defined in terms of a specialty, and because following a single specialty through more than one grade might easily result in qualifying for an intensity score, this target profile has a value of zero for this descriptive concept. In the absence of a qualifying specialty, supportive diversity cannot be present, requiring a score of zero. Similarly the absence of concentration requires a score of zero for the proximity concept.

The final pattern, Incidental/Personal, was devised to reflect the substantial numbers of students who take one or two courses only, who do not develop any area of concentration, and who do not explore across enough specialties to be otherwise classified. Because at least one course must be taken, a one is assigned to *diversity*. None of the other descriptive concepts apply for this pattern: the profile scores are therefore set at zero.

Hierarchy of the Patterns

The resulting score profiles of the five patterns were then tested against the criteria of ordered distances suggested earlier in this discussion and reflected in the following hierarchy where the letters and numbers reference the corresponding patterns.



Concentrators are taken as a starting point for this comparison because they are those students who demonstrate the most involvement in and commitment to vocational education by taking both a substantial number of courses and developing a concentration. Nearest to the Concentrators are the Limited Concentrators who differ primarily in degree. They still take a significant number of courses and specialize, but with less intensity, less continuity, and somewhat more diversity. Close to the Limited Concentrators are the Concentrator Explorers who show still less intensity, more diversity, and no commitment to a specialty in the final two years of high school. They are followed in order by the Explorers, whose major characteristic is diversity, but who may have accumulated a substantial number of vocational education credits. They are significantly involved in vocational education but do not develop any specialty. The individuals classified in Incidental/Personal are users of vocational education courses but they show no commitment nor substantial involvement in vocational education. They appear to represent a somewhat different dimension than the other four patterns, and therefore do not assume a predictable position in the same ordered sequence. The calculated results of the assigned values are presented in table 3.2.

Examination of this table reveals that the expected pattern is generally verified in terms of order, with the expected deviation for Incidental/Personal, thereby supporting the reasonableness of the assignment of values. The next step was to examine the data base of high school graduates to determine the adequacy of the patterns in describing what exists in the data. Of particular interest are those profiles that have squared Euclidian distances greater than the maximum within the target profiles and those that tie for two different patterns. The magnitude of the frequency with which these situations occur will be discussed in chapter 4.

TABLE 3.2

SQUARED TARGET PROFILE DISTANCE MATRIX

	C (1)	LC (2)	CE (3)	E (4)	IP (5)
C(1)	0	6.25	21	60	51
LC(2)		0	11.25	35.25	32.25
CE(3)			0	15	18
E(4)				0	9
IP(5)					0

NOTE: The values in the matrix are squared Euclidean distances.

Models for Analysis

Several factors were taken into account in the selection of the statistical methods and techniques used for analysis. For example, it was important to be able to test the viability of the proposed patterns in the data and to examine the patterns with regard to other independent variables that may influence vocational participation. In addition, the patterns identified in this report are to be used in subsequent parts of the study to examine the interview data for the possible effects of vocational participation upon labor market experiences and upon postsecondary education. As with any research inquiry the nature of the data and of the research questions demands careful consideration of the assumptions and requirements of the analytic approaches selected. Given these factors, a number of analytic techniques were potential candidates for use.

The Euclidean distance function of cluster analysis was utilized to match the data to the hypothesized patterns. This technique was the principal means by which vocational students were classified and the patterns of participation defined. However, because all approaches to analysis are built on certain assumptions, which in turn require judgments about the degree to which they are met, it is desirable to provide alternative analyses whenever possible as a check of these assumptions. Cluster analysis and discriminant function analysis were applied to the data for this purpose. A full-scale cluster analysis of a sample of the data was completed to determine whether results similar to those found with the Euclidean distance technique would be achieved. A discriminant analysis was also applied to ascertain the relative contribution of each of the concept scores in the individual patterns to the assignment of cases to a pattern.

Comparisons of the pattern groups with several socio-demographic variables were also made. This approach is a beginning attempt to ascertain the possible relationships between the type of vocational participation and other influential factors. This objective will be further developed in the subsequent papers in this series. The results of these analyses are presented in chapter 4.

CHAPTER 4

RESULTS

The application of the analytic techniques outlined in the previous chapter produced several different, yet related, types of results. The assignment of cases to patterns was accomplished by selecting a profile of scores that was judged to fit each pattern. The transcript cases were compared to these target profiles and were assigned to the pattern to which each was most closely matched. Subsequent analyses were designed to test the adequacy of the profile matching technique. Other factors that may influence vocational participation were explored by using cross tabulations of the variables of interest and the pattern groups. In brief, this chapter presents the results of the patterns classification, two tests of the methods used to identify the patterns, and a comparison of the types of participation with other factors.

Profile Matching Results

The classification of the transcript cases into the pattern groups is shown in table 4.1. Substantial differences in the frequency and types of participation are readily observed. For example, the data show that only 22 percent of the secondary graduates had no vocational credits. This finding indicates a clear majority of students are receiving some level of vocational instruction. However, of those persons who had exposure to vocational courses and were subsequently placed in a pattern, nearly one-half were classified in the Incidental/

TABLE 4.1

FREQUENCY AND PERCENTAGE DISTRIBUTION OF THE PATTERNS OF PARTICIPATION

Pattern Name	Unweighted	Weighted	
	Frequency	Relative Percentage	Adjusted Percentage
Concentrator	345	10.8	13.8
Limited Concentrator	577	18.1	23.1
Concentrator/Explorer	352	10.2	13.1
Explorer	49	1.4	1.8
Incidental/Personal	1104	37.5	48.1
No Vocational Credits	627	22.0	_____
Total	3054	100.0	100.0

NOTE: The adjusted percentage represents the distribution of high school gradutes with vocational credits.

Personal category. This pattern is characterized by the generally low number of vocational credits and the assumption of a limited investment in vocational education. Approximately 23 percent of the cases were placed in the Limited Concentrator pattern and nearly equal proportions of students were assigned to the Concentrator and Concentrator/Explorer groups. Collectively these three patterns account for 50 percent of the activities of students in vocational courses. Less than 2 percent of the cases were identified as Explorers; this finding suggests relatively few students are experimenting in a variety of vocational areas without some level of concentration in one program area.

The mean concept scores of each pattern can be used to further describe the nature and extent of vocational participation and are presented in table 4.2. The mean concept scores indicate the within-pattern values for each of the variables used to classify the cases in a pattern type. The results show Concentrators take an average of six vocational credits over a three-year period, which includes the eleventh and twelfth grades. Limited Concentrators take about half the number of credits as Concentrators, in a two-year span, in the last two years. The next pattern group, Concentrator/Explorer, takes slightly fewer course credits (approximately two and one-half) and completes the work in a two-year time frame, but most frequently takes the courses early in high school years. Although the diversity scores slightly increase between these groups, the number of areas sampled appears to be limited. The Explorer group is most unique in this respect. Students classified in this pattern type take courses in three or more different areas but do not achieve any level of specialization, as reflected by the intensity score. The last group, Incidental/Personal, averages less than one full credit and completes the course work in a half year's time. Again, the diversity score shows students in this category are generally receiving instruction in only one vocational area.

The original target profile scores are also provided in

TABLE 4.2

MEAN CONCEPT SCORES AS DERIVED FROM THE EUCLIDEAN DISTANCE CLASSIFICATION OF TRANSCRIPT CASES

Pattern Name	Mean Concept and Profile Assignment Scores				
	Intensity	Diversity	Continuity	Supportive Diversity	Proximity
Concentrator	6.3	1.2	3.0	0.1	2.9
Limited Concentrator	3.3	1.4	2.0	0.1	2.7
Concentrator/ Explorer	2.6	1.5	1.7	0.0	1.0
Explorer	0.0	3.1	0.0	0.0	0.0
Incidental/ Personal	0.8	1.2	0.6	0.0	0.6

table 4.2 for reference. The scores give some indication of how well the hypothesized profiles fit the data. Within the Concentrator group, for example, the average intensity score was somewhat higher than the target value of five, and the mean scores for continuity and supportive diversity were lower. Other moderate deviations from the target profiles are also in evidence, as expected.

The target profiles were developed to represent the modal tendencies of each pattern, and while the characteristics of each pattern may be similar on several dimensions, one or more of the concepts must differentiate between the groups. The concepts that appear to contribute the most to the differentiation between the patterns are intensity, continuity, and proximity. The average values for the diversity concept show only slight deviations between the patterns, with the exception of the Explorer category. Similarly, the supportive diversity scores show little difference among the groups.

One step in analyzing the adequacy of classification involved identifying the unique profiles that were classified within each pattern cluster. Those that were most distant from the assigned pattern, or were close to two patterns, were evaluated against the assumptions to check the logical consistency of the assignment. A small number of cases, approximately 4 percent, were judged to be questionable. These cases included two actual ties between the Concentrator/Explorer and Incidental/Personal categories. In both situations the student had accumulated several vocational credits but had not taken the courses in the eleventh and twelfth grade.

A rough estimate of the "fit" of the transcript cases to the target profiles can be obtained by examining the mean assignment scores for each pattern group. These scores are the averages of the distance of each case in each group from the target profile. These scores provide a limited indication of the distance the actual cases are away from the target profiles. A larger mean assignment score signifies that the cases are a greater distance from the target profile than a smaller assignment score. The means and standard deviations of the assignment scores are as follows:

- Concentrator mean 7.4, standard deviation 9.2
- Limited Concentrator mean 5.0, standard deviation 1.8
- Concentrator/Explorer mean 0.9, standard deviation 1.6
- Explorer mean 0.9, standard deviation 0.3
- Incidental/Personal mean 2.9, standard deviation 2.6

The data show the cases classified in the Explorer pattern clustered closely around the target profile. This indicates that this group is unique among vocational students. An interesting observation is noted for the Concentrator group. Case profiles of several persons classified in this category were found to have intensity scores of ten or more (i.e., the student had taken ten vocational credits in one program area). While there is a marked difference between this concept score and the target profile score of five, and thus the squared differences between the scores are quite large, these cases are closer to the Concentrator pattern than other pattern types. The result of this anomaly, a large number of credits in vocational education, is a substantially higher mean assignment score for this group than others. The profile matching classification method was successful in assigning nearly all cases to a pattern type, although it should be recognized that the groups are either more or less homogeneous depending upon the separation of clusters within the population.

Cluster Analysis

As was noted in chapter 3, the cluster analysis method was selected to test the viability of the hypothesized patterns in the data and the classification technique. The "K-means" clustering method, which is a nonhierarchical clustering technique and is well suited for large scale data sets, was used for this task.* Rather than attempting the formidable task of combining all possible groupings of sets of scores in a data base, it is designed to begin with a specified set or with a prespecified number of randomly selected sets, thereby reducing in geometric proportion the number of comparisons to be made. These initial sets are called "seed points." The K-means program uses "seed points" (or centroids) as the cluster nuclei for a specified number of clusters, and individual cases are assigned to the cluster that contains the seed point to which the case is closest. The seed points can be selected in advance or randomly chosen from the data. In the first cycle through the data, each case is placed in the cluster with the nearest seed point and all cases are initially assigned to a cluster. New seed points are then computed. With the updated centroid coordinates, another pass through the data occurs and any individual case may be reassigned to a new cluster to which it is closer. These steps are alternated ". . . until the process converges; that is, (it) continue(s) until no data units (or cases) change their cluster membership" (Anderberg 1973, p. 161). Because the seed points remain fixed throughout each cycle of data, the sequence in which the cases are read by the program does not affect the final set of clusters or the centroid coordinates.

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* The project staff would like to express our gratitude to Dr. Glenn Milligan for the use of his K-means clustering program which was adopted from Anderberg's work (1973).

Even with the efficiencies of the K-means technique, a complete analysis of the data set for this study was beyond the capacity of the available computer facility. Therefore, once the transcript cases had been assigned to a pattern type by the Euclidean distance technique, a stratified random sample was drawn from the complete secondary graduate data set to be tested with the K-means method. Two 10 percent samples of each of the pattern groups were randomly selected for the subsamples, except the Explorer category in which all the cases were used. (The low frequency of Explorers in the data suggested the maximum number of cases be present in order for this pattern to emerge; using 10 percent of the other pattern types ensured that each group would be proportionally represented and permitted a comparison of the full-scale profile matching results with the K-means clustering results.) The second sample served as a cross validation of the first. The target profiles were used as the seed points for separate analyses of the two subsamples. The same subsamples were also used for analyses, which required that the initial seed points be randomly selected from the transcript cases (i.e., rather than the target profiles being used as the centroids, five actual cases were used as the seed points for other cases to cluster around). In both the target and random profile situations the seed points were permitted to float in each cluster as new cases were added. This feature distinguishes the K-means process from the Euclidean distance measure and facilitates an independent comparison of the classification scheme.

The results of the K-means cluster analysis with the target profile seed points are shown in table 4.3. The distribution of the cases by pattern type for the two subsamples, labeled Sample A and Sample B, is shown in the table and the centroid coordinates for each cluster are given. Profiles represent variability in multidimensional space as opposed to scores on a continuum. The centriod coordinate is a mean vector with a coordinate value for each spatial dimension. The mean

TABLE 4.3

CENTROID COORDINATES OF THE PROFILE CONCEPT SCORES AS DERIVED FROM K-MEANS CLUSTER ANALYSIS WITH THE TARGET PROFILE SEED AND THE MEAN CONCEPT SCORES FOR THE EUCLIDEAN DISTANCE CLASSIFICATION

Pattern Name		Profile Concept Coordinates				
	n	Intensity	Diversity	Continuity	Supportive Diversity	Proximity
Concentator						
Sample A[1]	45	6.2	1.3	2.7	0.1	2.8
Sample B	45	6.3	1.3	2.7	0.1	2.7
Mean Concept Score		*(6.3)*	*(1.2)*	*(3.0)*	*(0.1)*	*(2.9)*
Limited Concentrator						
Sample A	54	3.1	1.3	2.3	0.0	2.7
Sample B	41	3.1	1.3	2.4	0.0	2.9
Mean Concept Score		*(3.3)*	*(1.4)*	*(2.0)*	*(0.1)*	*(2.7)*
Concentrator/Explorer						
Sample A	69	1.9	1.4	1.3	0.0	1.5
Sample B	64	2.3	1.3	1.4	0.0	1.1
Mean Concept Score		*(2.6)*	*(1.5)*	*(1.7)*	*(0.0)*	*(1.0)*
Explorer						
Sample A	60	0.0	2.9	0.0	0.0	0.0
Sample B	56	0.0	2.9	0.0	0.0	0.0
Mean Concept Score		*(0.0)*	*(3.1)*	*(0.0)*	*(0.0)*	*(0.0)*
Incidental/Personal						
Sample A	76	0.7	1.1	0.6	0.0	0.2
Sample B	82	0.7	1.1	0.6	0.0	0.6
Mean Concept Score		*(0.8)*	*(1.2)*	*(0.6)*	*(0.0)*	*(0.6)*
Total n						
Sample A	304					
Sample B	288					

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[1] The number of cases reported in each pattern for Sample A and Sample B represents the final cluster size after the analysis was completed. The mean concept scores shown in the table are reproduced from table 4.2.

descriptive concept scores are analogously the coordinate scores of the profile vector. These scores are shown in parentheses for comparison.

The centroid coordinates of the Sample A and Sample B analyses reveal strikingly similar results in all pattern groups. The greatest disparity in the coordinates of each sample is found in the Concentrator/Explorer cluster; in this group a minimal difference is noted in each of the cells, except for supportive diversity. A within-cell comparison of the target profile seed results and the mean concept scores shows the majority of the values are either an exact match or within 0.1 to 0.3 difference. The largest deviation is found for the intensity score in the Concentrator/Explorer group--a difference of 0.7. In general, the K-means clustering method produced results comparable to the Euclidean distance classification scheme.

The profile concept coordinates for the five clusters obtained from the random seed points analysis are shown in table 4.4. These results are of particular interest because the cases were permitted to cluster themselves rather than being restricted by the target profile starting points. As expected, the differences in the coordinates between Sample A and Sample B are somewhat larger and fewer exact matches are observed as compared to those found with the target profile seed. With the target profile seed, nine differences are observed between the cells in the two analyses with an average 0.08 difference across all

TABLE 4.4

CENTROID COORDINATES OF THE PROFILE CONCEPT SCORES AS DERIVED FROM K-MEANS CLUSTER ANALYSIS WITH THE RANDOM CASE SEED AND THE MEAN CONCEPT SCORES FOR THE EUCLIDEAN DISTANCE CLASSIFICATION

Pattern		Profile Concept Coordinates				
	n	Intensity	Diversity	Continuity	Supportive Diversity	Proximity
Concentrator						
Sample A[1]	43	6.3	1.2	2.7	0.1	2.9
Sample B	27	7.2	1.3	2.7	0.1	3.0
Limited Concentrator						
Sample A	49	3.6	1.3	2.3	0.0	2.3
Sample B	31	4.6	1.4	2.7	0.0	2.5
Concentrator/Explorer						
Sample A	71	1.8	1.4	1.[illegible]	0.0	2.0
Sample B	75	2.5	1.3	1.8	0.0	1.9
Explorer						
Sample A	87	0.0	2.3	0.0	0.0	0.0
Sample B	56	0.0	2.9	0.0	0.0	0.0
Incidental/Personal						
Sample A	54	1.2	1.1	1.0	0.0	0.3
Sample B	99	1.0	1.1	0.7	0.0	0.5
Total n						
Sample A	304					
Sample B	288					

[1] The number of cases reported in each pattern for Sample A and Sample B represents the final cluster size after the analysis was complete. The mean concept scores shown in the table are reproduced from table 4.2.

cells; the random seed results show fourteen differences between the cell values for Samples A and B and an average difference of 0.22. Also, compared to the mean concept scores derived from the profile matching classification, the random seed method yielded slightly greater differences than the target profile seed method. For example, the differences in the intensity scores for the Concentrator, Limited Concentrator, and Concentrator/Explorer groups between the random seed and the distance function technique are 0.8 and greater.

It should be noted that the distribution of the cases ('n' in the table) among the five clusters obtained by the random seed method is significantly different between Samples A and B. Recognizing similar proportions of each pattern type entered into both analyses, similar frequencies might be expected. However, because the initial starting points for both samples were randomly selected and because the clusters contain some overlap, any movement of the cluster centers would result in the reclassification of cases. The primary concern in conducting the random seed analysis was to determine whether or not similar profiles were obtained by a different method and if the profiles stayed within a reasonable distance of the profiles resulting from the Euclidean distance classification. This objective was accomplished. While the centroid coordinates did drift from the mean concept scores, the characteristics of each profile did not change substantially. Overall, the similarity in the centroid coordinates of the resulting cluster provides ample substantiation for the use of the profile matching classification scheme and lends support to the verification of the proposed pattern types.

Discriminant Analysis

In addition to the case by case judgmental evaluation and the cluster analysis results, a discriminant analysis was run to ascertain to what degree the pattern clusters could be produced independently of the target profile comparisons.

Discriminant analysis is a special case of canonical correlation analysis in which a weighted combination of scores on a set of variables is derived in a manner that provides the most unambiguous assignment of cases to classification (see, for example, Thorndike 1978). Being a member of the family of the product-moment-based analyses, it primarily reflects the shape of the profiles being compared. It can only be applied after an initial assignment to categories has been made, because group membership must be known before the optimum score combinations can be determined. Because the same scores were used for both the Euclidean distance function and the discriminant analysis, similarity of results was expected. However, the two approaches use the scores in a different manner, and identical results cannot be assumed. The distribution of patterns in the data was known to be unequal according to the previous classification, indicating that the restriction of equal probability of assignment was not appropriate. In this analysis, the patterns to which cases were assigned by the Euclidean distance function program were given as categories. The individual concept scores were then treated as independent variables for the purpose of calculating discriminant functions and reclassifying the cases on the basis of these functions.

TABLE 4.5

CLASSIFICATION BY DISCRIMINANT FUNCTION

Actual Group Membership	Percentage Predicted Group Membership				
	C	LC	CE	E	IP
Concentrator (C)	87.8	10.1	2.0	0.0	0.0
Limited Concentrator (LC)	5.4	92.0	2.6	0.0	0.0
Concentrator/ Explorer (CE)	0.0	11.6	75.3	.6	12.5
Explorer (E)	0.0	0.0	0.0	100.0	0.0
Incidental/ Personal (IP)	0.0	0.0	0.0	0.0	100.0

Percentage Correct Prediction = 92.79

The match between the two methods of classification was successful in approximately 93 percent of the cases. Two groups were perfectly predicted, Explorers and Incidental/Personals. Concentrators and Limited Concentrators had small percentages classified in adjacent patterns but 88 percent or more were correctly classified. The Explorer/Concentrator pattern was the least well classified, although more than 75 percent fell in the correct category. The remaining 25 percent were nearly equally divided between Limited Concentrators and Incidental/Personal patterns. Both of these are closely adjacent to the correct category. Although a rigorous statistical statement cannot be made about the comparability of these two classifications, the fact that they are remarkably similar is judged to be supportive of the adequacy of the classification procedure--Euclidean distance, used to assign cases to patterns for the purposes of analysis.

Differences Among the Patterns of Participation

The concluding section in this chapter provides a comparison of the patterns classification results and several sociodemographic variables, specifically race, sex, and family socioeconomic background.* In addition, a cross tabulation of the pattern groups by the program area of specialization, as determined from the transcript data, and self-report of curriculum are presented. These analyses are intended as a preliminary step toward determining the influences and effects of vocational course taking at the secondary level. To facilitate the discussion of the results the five pattern groups are collapsed into two categories. Persons who were classified in the Concentrator, Limited Concentrator, and Concentrator/Explorer groups are discussed collectively, and the Explorer and Incidental/Personal groups are considered together. Nonvocational students are treated separately in the discussion.

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* A table showing a comparison between the pattern assignments and students' self-report of curriculum is presented in Appendix E.

Categories of the variables, race, sex, and program area, have been previously defined. The socioeconomic status (SES) variable was derived using four intercorrelated indices of family background. The variables used to construct SES include a measure of the family learning environment at age fourteen (i.e., whether newspapers and magazines were received regularly and if persons in the household had a library card), mother's and father's educational attainment, father's (or mother's if the father was absent) occupational prestige score when the respondent was fourteen years of age. A principal components analysis was used to obtain the appropriate weights for each of the variables and were used with the standarized scores to secure a composite score for SES for each respondent. The cutoff points for the high, average, and low SES categories were based on the assumption of a normal distribution of SES in the population. Because youth on a lower socioeconomic level are somewhat less likely to complete high school, the reduced sample used for analysis contains a lower percentage of low SES respondents than the expected normal distribution. Similarly, high SES youth are represented in the sample at a higher rate than expected.

Before reviewing the results a brief note concerning the interpretations of the percentage and frequency distributions in the tables is necessary.* The analyses were conducted using the weighted cases, a process that renders the data applicable to the national population. The weighted percentages were then used to reallocate the actual number of cases into the appropriate cells in the tables. Therefore, the number of respondents shown in the tables reflects the actual sample size, although they are proportionally distributed based on the estimates of the youth population. This procedure permits the data to be more representative of the vocational participation patterns among high school graduates.

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* The n in the table is reduced by two from the original sample to account for two cases which were tied and could not be classified in a pattern group.

Patterns by Race and Sex

Table 4.6 shows the race and sex distribution of the pattern groups. Using the categories previously described, several differences are observed in the magnitude of participation among the race and sex subgroups. For example, females show higher rates of participation in the Concentrator, Limited Concentrator, and Concentrator/Explorer patterns than males. Overall, approximately 47 percent of all female secondary graduates were classified in the patterns that are characterized by higher levels of participation in vocational courses and programs. The comparable estimate for male graduates is about 30 percent.

When the frequency of placement is summed up within the racial subgroups, a higher percentage of Hispanics and blacks are classified in these patterns than whites. Forty-three percent of both minority groups were assigned to the three pattern categories compared to 38 percent of the white

TABLE 4.6

PATTERNS OF PARTICIPATION BY RACE AND SEX

Pattern Name	Race and Sex						
	Hispanic Males	Black Males	White Males	Hispanic Females	Black Females	White Females	Row Total
Concentrator	9.1%*	10.3%*	8.3%	10.5%*	10.8%	13.3%	10.8%
Limited Concentrator	16.0%	16.7%	14.4%	23.5%	23.1%	20.8%	18.1%
Concentrator/Explorer	11.2%*	7.0%*	7.1%	14.8%	16.7%	12.4%	10.2%
Explorer	2.4%*	0.8%*	1.4%*	1.5%*	1.9%*	1.4%*	1.4%
Incidental/Personal	36.6%	35.6%	39.2%	35.2%	32.8%	36.8%	37.5%
No Vocational Credits	24.6%	29.5%	29.6%	14.5%	14.7%	15.3%	22.0%
Column Total	100.0% (58)	100.0% (116)	100.0% (1,291)	100.0% (62)	100.0% (163)	100.0% (1364)	100.0% (3054)

NOTE: The number in parentheses represent the reallocated unweighted sample size that is based on the weighted distribution of cases. The percentage in the table may not add up to 100 due to rounding. The asterick (*) indicates the estimates are based on less than 25 actual cases.

graduates. Half (50.6 percent) of the black females were identified as either a Concentrator, Limited Concentrator, or Concentrator/Explorer. The lowest rate of assignment into these patterns was found for white males, about 30 percent.

Less substantial differences were found in the Explorer and Incidental/Personal grouping. Participation of this type, which reflects a minimal involvement in vocational education, was somewhat higher for males than females. Approximately 39 percent of the male students were placed in these pattern groups, compared to an estimated 36 percent of the females. The race variable exhibits slight differences in the frequency of assignment to these pattern groups. For example, it is observed that a somewhat higher percentage of whites were identified as Incidental/Personals than Hispanics or blacks; the percentages of cases classified in this pattern were 38 percent (white), 36 percent (Hispanic), and 34 percent (black), respectively. (The number of actual cases in the Explorer pattern limits the interpretation of the possible relationships between this pattern and race or sex.)

Examination of the remaining category, students with no vocational credits, shows clear differences in the distribution of cases that can be associated with the sex variable. Across all race groups, only 15 percent of the female students had not pursued any vocational coursework. In comparison, approximately 29 percent of the male graduates had not participated in a vocational course. As expected, given the relatively even distribution of cases in the other pattern groups, the differences by race are minimal. Hispanic youth appear to be the least likely to complete a high school program without experiencing some level of vocational instruction, approximately 19 percent. However, the transcript records of 21 percent of the black graduates and 22 percent of their white peers also indicated no vocational experience.

In brief, the data show that sex had a differential effect on whether or not vocational courses were taken and that, within the pattern groups, sex appeared to be associated with the nature of participation. Not only were females more likely to participate in vocational education, but also they showed a greater tendency to be classified in the Concentrator, Limited Concentrator, and Concentrator/Explorer patterns. This finding may be a reflection, in part, of the general tendency of females to take more credits overall than males. The data indicate, however, that the difference in total credits between males and females is less than one Carnegie unit; females average 21.4 credits over four years compared to 20.7 credits for male students. The prerequisites and/or the entry points for certain vocational courses may be factors in the differential enrollment of males and females. For example, lower level office occupations courses, which are typically dominated by female enrollment, may be available to a wider segment of the secondary student population than more specialized courses (e.g., trade and industry), which may require going to a specialized vocational center or committing a larger block of school time. The data from the school survey lend support to one aspect of this possibility. High school students have access to courses in the office program more frequently than to other vocational areas.*

While differences by race for the overall rate of participation in vocational courses were almost negligible, Hispanic and black graduates showed a slightly greater likelihood to be assigned to the patterns that feature a more substantial commitment to vocational education. A possible explanation for this finding might be that the numbers and types of vocational programs available to minority and white youth may be different. Preliminary analysis of the school survey data and the findings of Wiley and Harnischfeger's (1980) research on the availability of vocational programs suggest the vocational course offerings do vary by race. However, an unambiguous conclusion about the relationship between race, school effects (i.e., type of programs available), and the nature of vocational participation cannot be made at this time.

Patterns by Socioeconomic Status

The patterns of participation in vocational education by low, average, and high socioeconomic status (SES) are shown in table 4.7. As noted for the previous table, the patterns of participation are discussed using three general categories of involvement with vocational education: those students with a substantial commitment to vocational education; those with only a cursory interest, primarily for personal reasons; and those students who did not participate in vocational education at all.

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* The following are the reported percentages of students in the transcript subsample who had access to vocational programs in secondary school: Agriculture (46.6 percent); Office (97.6 percent); Distributive Education (75.6 percent); Health (57.7 percent); Home Economics (84.4 percent); Trade and Industrial (86.1 percent).

For example, 54 percent of the students of low SES are shown to have participated rather extensively in vocational education as Concentrators, Limited Concentrators, and Concentrators/Explorers. In contrast, and reflecting other studies, only 19 percent of students with a high SES background extensively participated in vocational education. The percentage of participation for the Concentrators in particular emphasizes the difference between those two levels of SES. Low SES had 17 percent of the students, while the high SES had only 2 percent of the students. The average SES group always had values between the low and high SES groups for both the groupings of patterns and for each pattern of participation, reflecting the overall distribution of patterns of participation. (See table 4.1.)

The grouping of Incidental/Personals and Explorers showed the least differentiation among the three SES levels: 31 percent of the low SES students were in this grouping, as compared with 38 percent middle SES students and 45 percent high SES students. The percentages of students who did not participate in vocational education were more divergent, (as they were for the Concentrator grouping): 15 percent for the low SES students, 18 percent for the middle SES students, and a substantial increase for the high SES students, 37 percent.

The findings indicate that there are substantial differences among the patterns of participation between and among the various SES levels. Since the family socioeconomic status of a student has been a major contributor in the identification and description of outcomes of vocational education, these differences must be important considerations in subsequent studies.

Patterns by Program Area

Several interesting comparisons may be found in Table 4.8 reflecting the nature of vocational education participation both in general and by specialty. Seventy-eight percent of the students participated at some level in vocational education. Of these, 39 percent of the total sample participated in a manner that was unlikely to result in the development of marketable skills. They were the Explorers and the Incidental/ Personals. They either took few courses, usually less than two credits, or sampled a variety without establishing any specialty. The courses taken were most frequently in the office occupations specialty. Not only did the largest sample group of individuals take one or two courses in this speciality. but of those concentrating in this specialty, nearly half, 47 percent, participated in this manner. Of those who were more involved in

TABLE 4.7

PATTERNS OF PARTICIPATION BY FAMILY SOCIOECONOMIC STATUS

Pattern Name	Socioeconomic Status			
	Low	Average	High	Row Total
Concentrator	17.4%	12.8%	1.6%*	10.8%
Limited Concentrator	21.6%	19.7%	11.4%	18.1%
Concentrator/Explorer	15.4%	11.0%	5.5%	10.2%
Explorer	2.8%*	1.4%	0.8%*	1.4%
Incidental/Personal	27.7%	36.9%	43.7%	37.5%
No Vocational Credits	15.0%	18.1%	37.1%	22.0%
Column Total	100.0% (296)	100.0% (2,086)	100.0% (672)	100.0% (3054)

NOTE: The number in parentheses represents the reallocatd unweighted sample size, which is based on the weighted distribution of cases. The percentages in the table may not sum to 100 due to rounding. The asterick (*) indicates the estimates are based on less than twenty-five actual cases.

TABLE 4.8

PATTERNS OF PARTICIPATION BY PROGRAM AREA OF SPECIALTY

Pattern Name	Program Area of Specialty							
	Agriculture	Office Occupations	Trade & Industry	Distributive Education	Health	Home Economics	No Specialty	Tota
Concentrator	30.3%	14.2%	27.9%	4.9%*	16.2%*	9.8%*	0.0%	10.
Limited Concentrator	27.2%	23.8%	39.7%	47.0%	35.6%*	46.4%	0.0%	18.
Concentrator/Explorer	17.6%*	15.5%	14.3%	16.1%*	37.8%*	26.6%*	0.0%	10.
Explorer	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	1.
Incidental/Personal	24.9%	46.5%	18.1%	37.0%*	10.5%*	17.2%*	35.1%	37.
No. Vocational Credits	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	61.0%	22.
Column Total	100.0% (110)	100.0% (1,373)	100.0% (314)	100.0% (86)	100.0% (28)	100.0% (42)	100.0% (1,101)	100. (3,05

NOTE: The number in parentheses represents the reallocated, unweighted sample size, which is based on the weighted distribution of cases. The percentages in the table may not add up to 100 due to rounding. The asterick (*) indicates the estimates are based on less than twenty-five actual cases.

a given specialty area, 29 percent had substantial concentration in the area. These are Concentrators and Limited Concentrators. It is among these two groups that the true effects of vocational education should be expected to emerge.

Next in frequency of participation is the trade and industry group. Substantial concentration is shown by 68 percent of the group, with only 18 percent involved in the Incidental/Personal category and 14 percent having some concentration early in the school years or perhaps compressed into a single year. The agriculture specialty is the only group with the majority of its participants as Concentrators. This may be a reflection of greater availability of courses throughout the high school years. Twenty-five percent of the agricultural group participated in an Incidental/Personal pattern, with all others having sufficient concentration to anticipate accumulation of marketable skills.

Some of the specialty areas, namely distributive education, health, and home economics, do not have sufficient sample sizes to have a well-supported interpretive meaning. Oversampling of students in distributive education and health programs would be necessary in order to obtain an adequate number of respondents. The low frequency of students in these program areas also may be partially attributable to the limited availability of the programs in most secondary schools. The rigorous criteria by which home economics students are classified in this study is likely to affect the frequency of respondents in this specialty.

Patterns by Self-Report of Curriculum

A cross tabular comparison of the pattern assignments and students' self-report of curriculum is presented in table 4.9.* The data show clear differences within and between the three curricular areas of vocational, general, and college preparatory. As anticipated, a majority of students who reported having a vocational program in high school were classified in patterns that are characterized by a heavy involvement in vocational education. Over 72 percent of the self-identified vocational graduates were assigned to the Concentrator, Limited Concentrator, and Concentrator/Explorer patterns. Within this major category the Concentrator and Limited Concentrator groups are most frequently represented. One-fifth of the vocational youth, however, were classified in patterns that feature a minimal involvement in vocational programs--Explorer and Incidental/ Personal patterns. The data also indicated approximately 7 percent of the vocational respondents did not have any vocational course credits recorded on their transcripts.

Slightly more than 80 percent of the general curriculum students participated in vocational programs or courses to some degree. A nearly equal percentage of these students were in the

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* The self-report measure is based on the 1979 NLS interview question, "Do you feel that your program (is/was) largely vocational, commercial, college preparatory, or (is/was) it a general program?) Students who reported a commercial program were merged with the vocational category.

TABLE 4.9

PATTERNS OF PARTICIPATION BY SELF-REPORT OF HIGH SCHOOL CURRICULUM

Pattern Name	Self-Report of Curriculum			
	Vocational	General	College Preparatory	Row Total
Concentrator	34.4%	8.7%	2.7%	11.0%
Limited Concentrator	28.1%	19.7%	12.2%	18.2%
Concentrator/Explorer	9.7%	13.3%	7.5%	10.2%
Explorer	2.1%*	2.2%	0.5%*	1.5%
Incidental/Personal	18.9%	39.3%	44.1%	37.5%
No Vocational Credits	6.8%	16.8%	33.0%	21.7%
Column Total	100.0% (557)	100.0% (1245)	100.0% (1190)	100.0% (2992)

NOTE. The numbers in parentheses represent the unweighted sample size, which is based on the weighted distribution of cases. The percentages in the table may not add up to 100 due to rounding. The asterick (*) indicates that the estimates are based on less than twenty-five actual cases; missing cases are excluded.

Concentrator, Limited Concentrator and Concentrator/Explorer categories as were assigned to the Explorer and Incidental/ Personal grouping--about 42 percent in each major category. While a substantial number of college preparatory youth participated in vocational education (about 67 percent), these students were almost twice as likely to undertake only one or two courses, as reflected by the Incidental/Personal pattern, than to pursue a continuous sequence of courses and accumulate a number of vocational credits. Approximately 22 percent of the academic youth participated in the Concentrator, Limited Concentrator, or Concentrator/Explorer manner, compared to 45 percent in the Explorer and Incidental/Personal patterns.

The findings in the table lend support to the need for an alternative method of classifying vocational students for the purpose of evaluating the effects of vocational education. Substantial proportions of general and college preparatory students are receiving vocational instruction. Often, however, the vocational, general, and college preparatory curricula are considered to be unique and distinct categories and are consequently used to ascertain the possible effects of each on various indices of post-high school activities, specifically labor market experiences. However, these results suggest that enough overlap, in terms of vocational experience, exists between the three programs to account, in part, for the diverse findings reported in other studies regarding the effects of vocational programs.

The following chapter provides an integrative summary of the process by which the patterns of participation were developed and the subsequent results of the analyses. Several conclusions and recommendations for future research and for vocational education policy are also presented.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Purpose of the Study

Extensive studies have been done on the effects of vocational education, particularly in relation to labor market experiences. Depending on the manner in which vocational education is measured, the outcomes of participation will vary. Two classification characteristics in existing research studies have impeded a distinct classification of vocational education students: (1) the generic classification of educational program participation, which does not reflect variability in student course taking and (2) the potential unreliability of students' self-reports in the identification of the program in which they participated. This report is the first in a series of three to be completed using the NLS New Youth Cohort and transcript data to identify patterns of participation and relate them to various labor market and postsecondary education participation outcomes. This data base does not provide information on motivation, scheduling or program requirements. Nor does it provide any indication of the quality of programs available to students. Therefore, the purpose of this study was to develop a classification schema for vocational education students using data from high school transcripts from which to identify patterns of participation in vocational education.

Description of the Data

In an effort to circumvent classification difficulties in past research studies, high school transcript data for a subset of the NLS New Youth Cohort were collected by the National Opinion Research Center for the National Center for Research in Vocational Education in cooperation with the Center for Human Resource Research, The Ohio State University. The subset of students from the NLS Youth Cohort represents approximately 3,100 complete transcripts from high school graduates as of the 1980 interview who were seventeen to twenty-one years of age when originally selected for the NLS survey. The transcript data, listing the actual courses, the year taken, and the course credits awarded, provide a more extensive and cost-effective information base, coupled with the original survey data, from which to identify patterns of participation in vocational education and relate them to specified outcomes.

Although not discussed in this report, subsequent reports will relate the identified participation patterns to labor market outcomes and to participation in postsecondary education. This report describes the patterns identified in terms of nature and extent of participation, frequency, and sociodemographic and other related variables including program area.

Participation Assumptions

Patterns of participation were hypothesized, incorporating five descriptive concepts into five target profiles. The concepts are based on assumptions regarding vocational education and its delivery system: (1) courses in the eleventh and twelfth grades are more important to vocational attainment than those in the ninth and tenth grades; (2) continuity in an area is better than switching areas; (3) the more credits individuals have the better prepared they are; and (4) continuity in terms of school years is better than broken sequences.

Patterns' Descriptive Concepts

Five concepts were developed to reflect these assumptions and describe possible patterns of participation in vocational education: intensity, diversity, continuity, proximity, and supportive diversity. The concepts are expected to be functional in the following manner. Intensity of concentration should pay off in the form of accumulated skill development. These skills will become more available for use by continuous application over a period of time. Skills practiced up to the point of paid application will be more effective than those learned earlier and used infrequently. Finally, although diversity across many programs is not expected to pay off, certain diversity in skill areas judged to be supportive of other skill areas may improve the chances for success in job attainment and pay.

Patterns of Participation

Based on the profile scores assigned to a transcript for each of the five descriptive concepts, each case was assigned to one of the five hypothesized patterns of participation in vocational education. The five patterns that were developed are: Concentrators, Limited Concentrators, Concentrator/Explorer, Explorers, and Incidental/Personal users of vocational education. Concentrators and Limited Concentrators were expected to have relatively high scores in intensity, continuity, and proximity. They may have scores in supportive diversity, but will be limited in general diversity. Concentrator/Explorers may approach closely to Limited Concentrators in intensity and continuity, but do not display proximity. They may have scores in supportive diversity. Explorers have no scores in intensity, continuity, proximity or supportive diversity, but are characterized by sampling across most of the available programs. Incidental/Personal users of vocational education have one or two courses that do not cross enough program areas to be classified as Explorers but can be scored only in the diversity category, since they do not develop meaningful intensity of concentration.

Analyses Used

Analyses for the data were chosen keeping in mind the need to (1) test the viability of the proposed patterns and (2) examine the patterns with regard to other independent variables that may influence vocational education participation. The Euclidean distance function of cluster analysis was used to assign the transcript data (cases) to the hypothesized patterns. Several cluster analyses were done, using the target profiles as "seeds" and using random cases as seeds for the K-Means clustering method to determine how well the cases matched the patterns. A discriminant analysis was also applied to ascertain the independent contribution of each of the concept scores in the individual patterns to the assignment of a case to a pattern.

Results

Profile Matching. The classification of the transcript cases into patterns shows substantial differences in the frequency and types of participation. Only 22 percent of the secondary graduates had no vocational credits. Nearly one-half of students who had exposure to vocational education were classified in the Incidental/Personal category; less than 2 percent of the cases were identified as Explorers. Collectively the Limited Concentrator (23 percent), Concentrator (13 percent), and Concentrator/Explorer (13 percent) groups account for almost 50 percent of the activities of students in vocational courses.

Cluster Analyses. Two 10 percent samples of each of the pattern groups were randomly selected, except for the Explorer category in which all the cases were used, for the K-means cluster analyses. Both target profile and random case seed points were used for analysis for both samples. The centroid coordinates of the Sample A and Sample B analyses using target profile seed points show strikingly similar results in all pattern groups. As would be expected, the differences in coordinates between Sample A and Sample B are somewhat larger using random case seed points than differences in coordinates found when target profile seeds were used. Overall, the similarity in the centroid coordinates of the resulting clusters provide ample substantiation for the use of the profile matching classification scheme and lend support to the verification of the proposed pattern types.

Discriminant Analysis. In addition to the case by case judgmental evaluation and the cluster analyses results, a discriminant analysis was done to ascertain to what degree the pattern clusters could be produced independently of the target profile comparisons. Two groups, Explorers and Incidental/Personals, were perfectly predicted. Concentrators and Limited Concentrators had small percentages classified in adjacent patterns but were 88 percent or more correctly classified. The Explorer/Concentrator pattern was the least well classified, although more than 75 percent fell in the correct category. Although a rigorous statistical statement cannot be made about the comparability of these classifications, by target profiles and by Euclidean distance, the fact that they are remarkably similar is judged to be supportive of the classification procedure (Euclidean distance) used to assign cases to patterns for the purposes of analysis.

Participation by Sex and Race. Data describing the patterns of participation by sex and race show that sex has a differential effect on whether or not vocational courses are taken, and that within the pattern groups, sex appears to be associated with the nature of participation. Not only are females more likely to participate in vocational education, but they also show a greater tendency to be classified in the Concentrator, Limited Concentrator, and Concentrator/ Explorer patterns. Hispanic and black graduates also showed a slightly greater likelihood to be assigned to the patterns that feature a more substantial commitment to vocational education. Differences by race in the nonvocational category are almost negligible, with a maximum difference of 5 percent between Hispanic and black males.

Participation by Family SES. The patterns of participation by socioeconomic status (SES) levels reflect the findings, in part, of past studies. There is a substantial difference between the percentage of Concentrators for the low and high SES levels, as might be expected. The middle SES group's participation remained in the middle for all comparisons of the three SES levels. The middle SES also most closely reflected the overall distribution of patterns of participation (table 4.1). The findings also indicate that there are substantial differences of participation among the various SES levels; these differences may be important variables in subsequent studies of the relationship of participation to various labor market and education outcomes.

Participation by Program Area. The distribution of students across program areas by the patterns of participation is also described in chapter 4. The agriculture program area had 75 percent of the students participating at a high level of commitment. More agriculture students are Concentrators than are the students of any other specialty: a total of 30.3 percent. An overwhelming number of trade and industry program students also showed a high level of participation, 81.5 percent were Concentrators, Limited Concentrators, or Concentrator/Explorers. The Office occupations specialty showed the lowest percentage of students in those three patterns of participation, with almost half, 46.5 percent, in the Incidental/Personal category. Several specialties, distributive education, health, and home economics did not have sufficient sample sizes to have any interpretive meaning.

Conclusions

Based on the findings the following conclusions and recommendations are presented. Due to the preliminary nature of some of the data, they are somewhat tentative and general.

1. There is clear evidence of differences in patterns of participation among students in vocational education. Only 30 percent of students who participated in vocational education in this study were Concentrators and Limited Concentrators. This participation crosses the traditional lines of secondary curricula classifications--vocational education, academic, and general.

2. The classification procedure based on transcript data is a workable way to identify these patterns. It is suitable for evaluation at state and local program levels as well as for research purposes. The use of this classification method should improve the reliability of assignment to curricular patterns because it depends less heavily on subjective data.

3. Alternative analyses tend to support the validity of the classification approach by producing similar results. For

example, 92 percent of the cases were classified identically using discriminant analysis.

4. There are differences in the frequencies of patterns that are associated with race and sex. For example, approximately 85 percent of the female students had some vocational education experience; about 71 percent of the male students participated in vocational education. A breakdown of participation by race showed 81 percent of Hispanic students, 79 percent of black students, and 78 percent of white students were involved to some degree in vocational education experiences. Approximately 47 percent of the female graduates and 30 percent of the male graduates were assigned to patterns that involved a substantial commitment to vocational education. The comparative percentages in these patterns for the racial groups were blacks, 43 percent; Hispanics, 43 percent; and whites, 38 percent.

5. There are substantial differences in pattern frequencies asssociated with differences in socioeconomic status. There are also substantial differences in pattern frequencies within individual levels of socioeconomic status. Approximately 81 percent of the high SES had no vocational education experience or were classified as Incidental/Personal users. In contrast, approximately 43 percent of the low SES had no vocational education experience or were classified as Incidental/Personal users.

6. There are logically apparent differences in pattern frequencies among program areas of specialization. The largest number of Concentrators, 30 percent, are found in the agriculture program area, followed closely by 28 percent in the trade and industry program area. In contrast, 47 percent of the business and office occupation participation are classified as Incidental/Personal.

7. The pattern differences are hypothetically relatable to expected outcomes of participation in vocational education and, therefore, testable.

Recommendations

1. The method of classification of patterns of participation should be further tested against specific outcomes of vocational education.

2. Outcomes derived from using this particular classification of participation patterns should be compared with the outcomes of other classification methods. The evidence shows that there is sufficient inconsistency between student classifiction by self-report or by administrator assignment and actual program content to suggest that the outcomes of vocational education have not been adequately assessed.

3. This method of classification should be replicated with other populations.

4. In order to conduct effective vocational education research, it is essential to consider the variety of patterns of participation in vocational education. No single criterion can reflect the complexity of this experience.

5. This study should be replicated using transcript data for those students who were fifteen or sixteen when the New Youth Cohort interviews were first conducted.

The findings and recommendations suggest that policymakers consider carefully the diversity of participation in vocational education as they make decisions affecting the structure of programs, assignment of students, use of facilities, and delivery of services. The second and third papers in this series will address these recommendations in part to provide policy analysts with a rigorous, more factual base for their decisions.

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APPENDIX A

CREDIT UNIT/COURSE HOURS CONVERSION TABLE

Carnegie Credit Unit	Time in Course (Hours)	Percentage of Time in Grades 9-12
.25	45	1.04
.33	60	1.39
.50	90	2.08
.66	120	2.78
.75	135	3.13
1.00	180	4.17
1.25	225	5.21
1.33	240	5.56
1.50	270	6.25
1.66	300	6.94
1.75	315	7.29
2.00	360	8.33
2.50	450	10.42
3.00	540	12.50
3.50	630	14.58
4.00	720	16.67
5.00	900	20.83
6.00	1080	25.00
7.00	1260	29.17
8.00	1440	33.33
9.00	1620	37.50
10.00	1800	41.67
12.00	2160	50.00

NOTE: The base for the percentage of time in grades nine through twelve is derived from the assumption of a standard six hour school day, 180 days per year, for four years (or 4,320 hours in grades nine through twelve). The estimated percentages will vary for each case depending on the total number of credits received. The credit units shown in the table do not represent the entire range of possible credits.

APPENDIX B

DEFINITION OF VOCATIONAL COURSES AND PROGRAMS

The seven subject matter areas identified as "vocational" in Handbook VI (Putnam and Chismore 1970) are also used in this study. These categories are agriculture, distributive education, health occupations, home economics, office occupations, technical education, and trade and industrial occupations. Vocational courses and students' patterns of participation are classified using these course content descriptors. Several decision rules were adopted to accommodate the available data and refine the definition of vocational courses.

1. Technical education and trade and industrial occupations courses were combined and were designated as trade and industrial. The rationale for this action was twofold: (1) the difficulty of distinguishing between these areas by the course title alone at the time of coding and (2) the relatively low frequency of students in technical courses at the secondary level.

2. In an attempt to develop a finer measure of occupational home economics, only courses considered to be vocational were included in this classification. Homemaking related courses and consumer oriented courses are excluded in this analysis.

3. Business and industrial arts courses were differentiated from office occupations and trade and industrial courses,

and were not included as vocational courses. Courses classified as business and industrial arts are oriented to the acquisition of knowledge and skills that are primarily intended for personal use rather than vocational training. There is likely to be some overlap in the coding of courses that are so similar; given only the title of a course, Typing I, for example, it is difficult to distinguish between a business versus an office occupations perspective.

4. Because the major focus of this research is on the development of alternative measures of vocational participation, the use of student's self-report to identify the major area of study (e.g., agriculture, distributive education) did not seem appropriate. Assignment to an area of study should be based on the amount of participation in that program, contrasted to the extent of participation in other vocational areas. The decision was made to classify a case (or student's transcript data) in a specific program area if the student had one or more vocational credits and if at least 0.6 of the total vocational credits were in one area. Thus, a student may take courses in several vocational fields but is not considered to be specialized in one area unless these criteria are met.

APPENDIX C

TABLE C1: COMPARISON OF SELECTED CHARACTERISTICS OF THE WEIGHTED TRANSCRIPT SAMPLE AND THE NLS POPULATION ESTIMATES OF HIGH SCHOOL GRADUATES BY RACE AND SEX

Characteristic	Race and Sex						
	Hispanic Males	Black Males	White Males	Hispanic Females	Black Females	White Females	Row Total
Column Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Region							
Northeast	10.7%* (17.3%)	10.9% (18.1%)	23.5% (23.0%)	8.8%* (16.8%)	13.5% (18.8%)	22.8% (22.6%)	21.6% (22.0%)
North Central	7.9%* (7.3%)	24.3% (21.0%)	35.6% (34.8%)	9.4%* (8.5%)	20.3% (18.3%)	33.0% (32.0%)	32.2% (30.6%)
South	33.7% (30.7%)	56.9% (53.7%)	24.7% (25.4%)	31.0% (29.3%)	59.6% (55.9%)	27.6% (29.2%)	29.4% (30.6%)
West	47.7% (44.3%)	8.0%* (7.1%)	16.1% (16.8%)	50.9% (45.4%)	6.6%* (7.1%)	16.6% (15.2%)	16.8% (16.7%)
Residence							
Urban	90.3% (93.7%)	89.1% (87.2%)	79.9% (79.4%)	94.8% (95.1%)	90.7% (87.2%)	79.8% (78.9%)	81.3% (80.7%)
Rural	9.7%* (6.3%)*	10.9% (12.8%)	20.1% (20.6%)	5.2%* (4.9%)*	9.3% (12.8%)	20.2% (21.1%)	18.7% (19.3%)
Socioeconomic Status[1]							
Low	39.8% (42.3%)	20.8% (20.7%)	5.8% (7.0%)	42.7% (40.4%)	22.7% (24.1%)	8.1% (8.6%)	9.7% (11.1%)
Average	51.7% (49.2%)	69.8% (71.6%)	69.4% (70.2%)	51.3% (55.4%)	69.8% (70.2%)	68.5% (70.1%)	68.3% (69.5%)
High	8.5%* (8.4%)	9.4%* (7.7%)	24.7% (22.7%)	5.9%* (4.3%)*	7.5%* (5.6%)	23.5% (21.2%)	22.0% (19.2%)
Total N	207 (351)	415 (792)	4,620 (6,677)	223 (396)	581 (1,067)	4,877 (7,192)	10,924 (16,475)

NOTE: The table shows the percentage distributions of the transcript subsample used for analysis and, in parentheses the same for the entire NLS subsample of high school graduates (a subsample that is not affected by transcript availability). 'Total N' denotes the weighted cases in thousands; missing cases are excluded. The asterick (*) indicates that the estimates are based on less than twenty-five cases.

[1] The socioeconomic status (SES) variable was derived using principal components analysis and four intercorrelated indices of family background. The variables used to construct SES were a measure of family learning environment, mother's educational attainment, father's educational attainment, and father's (or mother's if father was absent) Duncan SES score when the respondent was fourteen years of age.

TABLE C2: SELECTED CHARATERISTICS OF THE WEIGHTED TRANSCRIPT SAMPLE BY RACE AND SEX

Characteristic	Race and Sex						
	Hispanic Males	Black Males	White Males	Hispanic Females	Black Females	White Females	Row Total
Column Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Year of Graduation							
1974-1976	29.1%	28.8%	35.6%	35.0%	32.7%	35.7%	35.1%
1977-1978	44.7%	45.0%	43.6%	43.1%	41.6%	42.8%	43.2%
1979-1980	26.2%	26.2%	20.8%	21.9%	25.7%	21.5%	21.7%
Class Rank							
25th Percentile	11.5%*	12.8%	21.9%	17.1%	21.4%	35.1%	27.1%
50th Percentile	21.3%	12.0%	17.6%	25.6%	19.3%	23.9%	20.6%
75th Percentile	29.0%	24.6%	24.5%	20.3%	22.9%	20.2%	22.5%
100th Percentile	38.2%	50.5%	36.0%	36.9%	36.4%	20.8%	29.8%
Class Size							
Less than 100	7.4%*	7.4%*	10.6%	6.8%*	7.0%	10.5%	10.1%
100-400	42.4%	45.3%	44.3%	35.5%	47.7%	42.3%	43.4%
Greater than 400	50.1%	47.3%	45.2%	57.7%	45.3%	47.2%	47.2%
Number of Vocational Programs Available							
0	1.1%*	3.5%*	1.1%*	2.1%*	2.1%*	1.8%*	1.6%
1-3	12.6%*	12.3%*	19.4%	8.2%*	16.8%	13.5%	16.0%
4-5	29.7%	30.8%	28.6%	26.7%	32.3%	30.4%	29.7%
6-7	56.6%	53.4%	50.9%	63.1%	48.7%	54.2%	52.7%
Total N	200	404	4,483	218	568	4,751	10,625

NOTE: Information for year of graduation is based on respondent's self-report; the other variables are derived from the respondents transcript and from the school survey. 'Total N' denotes the weighted cases in thousands; missing cases are excluded. The asterick (*) indicates that the estimates are based on less than 25 cases.

APPENDIX D

DEFINITION OF SUPPORTIVE DIVERSITY COURSES

The supportive diversity concept is based on the assumption that students may take vocational courses outside their program area that may be related (or supportive) of the major course work if the program was structured toward individual entrepreneurship. The speciality areas judged most likely to lead in this direction were agriculture and trade and industry. For agriculture, accounting, bookkeeping, and typing courses were judged to be related. The trade and industry program was determined to be structured toward individual entrepreneurship if one of the following courses was taken:

- Automotive mechanics
- Small engine repair
- Welding and cutting
- Masonry
- Textile/leather production
- Furniture
- Graphic arts
- Commercial photography
- Commercial art
- Carpentry
- Construction work cooperative
- Graphic arts work cooperative
- Metals work cooperative
- Wood work cooperative

In this instance, the accounting, bookkeeping, and typing courses were also judged to be related. When counted as a supportive diversity score, the actual credit received in accounting, bookkeeping, and typing is used.